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Air Quality Enhancement – Agricultural Odor

Agricultural Odor
Agricultural odors are a complex mixture of gases that can evoke a wide range of emotional and physiological responses when encountered via the sense of smell. Objectionable odors are mainly a community or individual perception issue, although some odorous compounds can cause health problems in high concentrations. Many different compounds can be the potential cause for odors from agricultural operations. However, these compounds can generally be classified as volatile organic compounds (VOCs), ammonia, or sulfurous compounds, such as hydrogen sulfide.

Benefits
Application of this enhancement will provide observable improvements in air quality by managing airborne odors from animal production and manure management, storage, and utilization.

Criteria for Agricultural Odor Enhancement Activity
Acceptance of this enhancement requires a participant to conduct an on-farm odor assessment to identify opportunities for managing odors from the farming operation. **In addition to conducting the odor assessment**, a participant must also choose at least one of the activities from the Tier I category below **OR** two or more of the activities from the Tier II category below.

Tier I Activities
- Use biofilters on enclosed structures to treat exhausts
- Use a wet or dry scrubber or bioscrubber on enclosed structures to treat exhausts

Tier II Activities
- Inject manure 2 inches or more below soil surface or incorporate applied manure within 24 hours
- Install, maintain, and enhance windbreaks to disrupt wind flow and dilute, intercept, and filter concentrations of odorous substances in the air
- Utilize an approved feed management system using animal nutrition planning to mitigate odors
- Use odor control additives in animal housing and/or manure storage structures and areas
- Implement an inspection, maintenance, and housekeeping plan at your facility

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References:

American Society of Agricultural and Biological Engineers Technical Standard EP379.4 Management of Manure Odors, January 2007 (http://asae.frymulti.com/request.asp?search=1&JID=2&AID=23560&CID=s2000&T=2)

Livestock and Poultry Environmental Stewardship Curriculum Lesson 40: Emission from Animal Production System (http://www.lpes.org/Lessons/Lesson40/40_Animal_Emission.html)

Livestock and Poultry Environmental Stewardship Curriculum Lesson 41: Emission Control Strategies for Building Sources (http://www.lpes.org/Lessons/Lesson41/41_Emission_Control.html)

Livestock and Poultry Environmental Stewardship Curriculum Lesson 42: Controlling Dust and Odor from Open Lot Livestock Facilities (http://www.lpes.org/Lessons/Lesson42/42_Controling_Dust_Odor.html)

Livestock and Poultry Environmental Stewardship Curriculum Lesson 43: Emission Control Strategies for Manure Storage Facilities (http://www.lpes.org/Lessons/Lesson43/43_Facility_Emissions.html)

Livestock and Poultry Environmental Stewardship Curriculum Lesson 44: Emission Control Strategies for Land Application (http://www.lpes.org/Lessons/Lesson44/44_Land_Application_Emissions.html)

Schmidt, Jacobson, and Janni, 2001, Preparing an Odor Management Plan, Department of Biosystems and Agricultural Engineering, University of Minnesota Extension Service (http://www.extension.umn.edu/distribution/livestocksystems/DI7637.html)

Schmidt, Janni, and Nicolai, 2004, Biofilter Design Information, Biosystems and Agricultural Engineering Update 18, University of Minnesota Extension Service (http://www.manure.umn.edu/assets/baeu18.pdf)

Clean Air Technology Center Air Pollutant Technology Fact Sheets, U.S. Environmental Protection Agency (http://www.epa.gov/ttn/catc/products.html)

Air Management Practices Assessment Tool, Iowa State University Extension Service (http://www.extension.iastate.edu/airquality/practices/homepage.html

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Required activity for all participants under this enhancement:

1. Conduct an on-farm odor assessment at your site (Odor-01)

An on-farm odor assessment looks at a producer's operation to identify potential odor sources, existing odor management measures, and opportunities for improvement. The assessment may be conducted by a certified third party with experience in odor and odor management associated with an animal production facility.

Odors can originate from many sources on the farm site. Some of the main sources of on-farm odors include:

- Animal areas (including houses, open lots, etc.)
- Manure storage
- Land application of manure
- Mortality storage and handling
- Feed storage and processing areas

Required Elements:

- Attach an inventory and analysis of potential odor-causing activities for each of the above-listed sources
- Provide evidence of existing odor management measures in place for the above-listed sources
- Provide a ranking of on-farm odor improvement opportunities for your site

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In addition to the required activity above for all producers, choose at least one of the activities from the Tier I category below OR two or more of the activities from the Tier II category below:

Tier I Activities:

2. Use biofilters on enclosed structures to treat exhausts (Odor-02)

A biofilter is a layer of organic material (woodchips, straw, compost, or other organic material) through which odorous air from an animal building is passed. Microbes in the organic material convert odorous compounds to more inert compounds, such as carbon dioxide and water. For a complete description of biofilter function, design, and operation criteria, see **Schmidt, Janni, and Nicolai, 2004, Biofilter Design Information, Biosystems and Agricultural Engineering Update 18, University of Minnesota Extension Service (http://www.manure.umn.edu/assets/baeu18.pdf).**

Required Elements:

- Attach design criteria and specifications, and operational specifications, for the biofilter specific to your operation. Include photographs of functioning biofilters on buildings at your operation
- Briefly describe your animal operation (including number of animals, type of facility, and biofilter placement) and your evaluation of the effectiveness of the biofilters to reduce odors coming off your operation

3. Use a wet or dry scrubber or bioscrubber on enclosed structures to treat exhausts (Odor-03)

A scrubber is an add-on control device designed to remove air pollutants from an exhaust stream via adsorption of the pollutants to a fixed media filter, a scrubbing liquid, or a combination of the two. A bioscrubber utilizes microbes in the scrubber to consume some or all of the pollutant compounds that are adsorbed. Wet scrubbers and bioscrubbers are effective at reducing both gaseous odorous compounds, as well as particulate to which odorous compounds may be adhered. Dry scrubbers generally have less effectiveness for gaseous odorous compounds, but are effective for particulate removal.

There are a variety of scrubber types that can be used to remove odorous compounds from exhaust air streams. In most cases, a producer should contact an air pollutant control technology design firm to assist in designing an exhaust gas scrubber system that meets the particular requirements (i.e., pollutants to control, size and operational limitations, etc.) for the farm site. The U.S. EPA has also developed fact sheets for many of the most common types of air pollution control technologies (including many types of scrubbers), which can be found at: http://www.epa.gov/ttn/catc/products.html.

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Required Elements:

- Attach design criteria and specifications, and operational specifications, for the scrubber specific to your operation. Include photographs of functioning scrubbers or bioscrubbers on buildings at your operation
- Briefly describe your animal operation (including number of animals, type of facility, and dry scrubber placement) and your evaluation of the effectiveness of the scrubber to reduce odors coming off your operation

Tier II Activities:

4. Inject manure 2 inches or more below soil surface or incorporate applied manure within 24 hours (Odor-04)

Directly incorporating solid, or injecting liquid animal manure into topsoil significantly decreases odor emissions, and can have additional fertilization benefits. When utilizing this activity, the cooperator shall not increase soil surface disturbance so that they cannot meet basic eligibility requirements. Any producer using this enhancement activity shall adhere to the relevant air quality design criteria put forth in Conservation Practice Standard 633, Waste Utilization.

Required Elements:

- Provide documentation of the dates, treatment acres, manure type, and manure application method (solid incorporation or liquid injection) for each field for each year of this enhancement

5. Install, maintain, and enhance windbreaks to disrupt wind flow and dilute, intercept, and filter concentrations of odorous substances in the air (Odor-05)

Windbreaks can help manage odors emitted from confined livestock and manure storage facilities. Windbreaks can help mix the odorous compounds vertically in the air by disrupting airflows around animal facilities; they can also intercept solid and liquid particles carrying odorous compounds on leaves and needles, serving as a filter to reduce the amount of odor being carried in the air. Any producer using this enhancement activity shall adhere to the relevant air quality design criteria put forth in Conservation Practice Standard 380, Windbreak/Shelterbelt Establishment.

Required Elements:

- Attach a drawing or aerial photograph of the operation showing the placement of windbreaks with respect to fields and/or animal and manure storage facilities
- Briefly describe your evaluation of the effectiveness of the new or renovated windbreak to manage odors coming off your operation

6. Utilize an approved feed management system with animal nutrition planning to mitigate odors (Odor-06)

Feed management and animal nutrition planning control inputs to animals, which reduces undigested or partially digested compounds. This, in turn, reduces chemical concentrations in manure, as well as the potential for odor emissions from the animals and their manure. Any producer using this enhancement activity shall adhere to the relevant design criteria put forth in Conservation Practice Standard 592, Feed Management.

Some management strategies that can be invoked include:

- Select livestock to genetically improve the efficiency of food conversion by the animal
- Feed less frequently
- Feed livestock based on sex, age and stage of production to match diet to nutritional requirements
- Provide feed with lower nitrogen and sulfur contents to reduce potential emissions of odorous compounds

Required Elements:

- Provide a copy of a feed management plan which utilizes feed rations for managing animal and manure odor
- Attach receipts showing purchase of feed rations used to implement the feed management plan
- Briefly describe your animal operation (including number of animals, type of facility, and feed management plan) and your evaluation of the effectiveness of the feed management system to reduce odors coming off your operation

7. Use odor control additives in animal housing and/or manure storage structures and areas (Odor-07)

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Odor control additives are combined with manure to reduce production of odorous compounds from the manure. Many additives are an enzyme- or bacteria-based treatment which enhances bacterial populations in the animal manure. Some additives counteract chemical compounds which can cause odor; others absorb or adsorb chemical compounds, or serve as deodorants to mask the generated odors. Some land grant universities have developed guidance, evaluation, and/or recommendations for specific applications of odor control additives, and this information may be helpful in developing the odor control plan. Any producer using this enhancement activity shall adhere to the relevant design criteria put forth in Conservation Practice Standard 591, Amendments for the Treatment of Agricultural Waste.

Required Elements:

- Provide a copy of an odor control additive plan which utilizes additives to reduce odor
- Attach receipts showing purchase of odor control additives for use in the odor control additive plan
- Briefly describe your animal operation, including number of animals, housing type, manure storage facilities, type and quantity of odor control additives you use, and your evaluation of the effectiveness of odor control additives to reduce odors coming off your operation

8. Implement an inspection, maintenance, and housekeeping plan at your site (Odor-08)

Proper inspection, maintenance, and housekeeping activities can be a simple, yet effective way to minimize emissions of odorous compounds. Examples of these activities may include, but are not limited to, the following:

1. Cleaning up spilled feed, manure, liquids, and other material expeditiously
2. Avoiding spillage of feed, manure, liquids, and other material
3. Inspecting and repairing water pipes, troughs, etc. for leaks
4. Maintaining surfaces (open lots, bedding areas, etc.) to promote adequate drainage
5. Cleaning up excessive settled dust particles in buildings that may adsorb odorous compounds and be re-entrained in the air

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Each of these relatively simple tasks, as well as other inspection, maintenance, and housekeeping activities, will help to minimize the conditions under which odorous compounds can be formed and emitted.

Required Elements:

- Provide a copy of a facility inspection, maintenance, and housekeeping plan for managing animal and manure odor
- Provide documentation of inspection, maintenance, and housekeeping activities conducted to implement the plan